Request For Information (RFI) for Utilization of the International Space Station Window Observational Research Facility

This Request for Information (RFI) issued by the National Aeronautics and Space Administration (NASA) Office of Earth Science (OES) is to investigate the potential for payload utilization of the International Space Station (ISS) Window Observational Research Facility (WORF). All interested parties are encouraged to provide comment to this RFI. The primary goal of this RFI is to seek interest in WORF utilization and potential sources for payloads. NASA will use the information for program planning and budgeting purposes only. Future procurement activities may or may not result from this fact-finding exercise.

The WORF is a rack facility planned to allow payloads to take data through the high optical quality nadir research window being built for the ISS. It is anticipated that Earth sciences will be the primary user of this facility. Three WORF payloads may reside on-orbit simultaneously, with one to two payloads taking data through the facility at any given time. On-orbit life coincides with the Shuttle launch schedule, with a minimum life of approximately three months. More detailed technical information on the capabilities of the WORF and the window may be found in the Attachments section of this RFI.

WORF utilization may include science, applications, technology demonstration, or outreach payloads. The OES is seeking concept definition, associated ROM costs, and maturity/risk assessments. WORF payloads may launch as early as 2001. All WORF payloads will be launched on the Shuttle.

All information received from this RFI will be compiled and used for planning purposes. Any proprietary information received should be marked appropriately. Sources are urged to describe their technology in sufficient detail to allow NASA to define subsequent proposal opportunities.

The information received in response to this RFI will be reviewed and summarized by several panels of experts. The summarized and synthesized recommendations may form the content of a procurement action that NASA may issue at a future date.

Table 1. Template for WORF response

Investigation Type	• Scientific • Applications • Education and outreach • Technology Demonstration
Investigation	• Description
Payload Description	• Top level hardware description • Resource requirements: mass, power, data, volume, thermal
Quantitative Assessment of Programmatic and Technical Risks	• Leveraging activities

Spending Profile	• ROM costs in FY-00 dollars • Identify all assumptions
Payload Master Schedule	• Integrated Schedule • Identify earliest operational date

SCHEDULE

Deadline for Submission: November 30, 1999

Responses may be sent via electronic mail to: oescomm@hq.nasa.gov

ATTACHMENTS:

ISS Orbit

The ISS orbit will have an inclination of 51.6 degrees with an altitude that varies between 350 and 470 Km due to the solar cycle. The ISS orientation is continuously nadir pointed to earth. The orbit regression rate is one full orbit in two months. The ISS will pass regularly through the South Atlantic Anomaly.

Window Observational Research Facility

The Window Observational Research Facility (WORF) will be a 1-rack facility on ISS built to take advantage of the high optical quality nadir research window. This facility will allow deployment of payloads as large as a 23-cm (9") film aerial photography camera; the optical quality of the window will allow deployment of payloads with optical diameters of up to 30.4 cm (12"). The WORF is being built by the Boeing Corporation at Marshall Space Flight Center, and will be installed on Utilization Flight 2 (UF-2) in mid-2001.

The nadir window in the U.S. Laboratory is a 50.8-cm (20") clear aperture, fused silica window with a total of four panes. The outer most pane, called the debris pane, is 0.86 cm (0.37") thick and serves as a sacrifice pane to absorb micrometeorite and orbital debris (MMOD) impacts without damaging the pressure panes and threatening the ISS with decompression. This pane is designed to be removable on-orbit, so that any progressive deterioration in the optical quality of the pane can be accommodated with a new pane. The next two panes are the secondary and primary pressure panes. These panes are 3.175 cm (1.25") thick. The innermost pane, the scratch pane, is designed to protect the primary pressure pane from damage due to loose tools and other debris in the ISS, and will be removable. The combined set of pressure panes and debris pane will have an average optical performance of $1/10^{th}$ wave peak-to-valley over 6" (reference wavelength of 632.8 nm), which will give it the best optical performance of any window flown on a manned spacecraft[1]. It is estimated that this window will be able to support, without window-induced optical degradation, a payload having a 30.4-cm (12") optical diameter. The window panes are given an anti-reflection coating which provides the best transmittance in the near UV, visible and near IR bands.

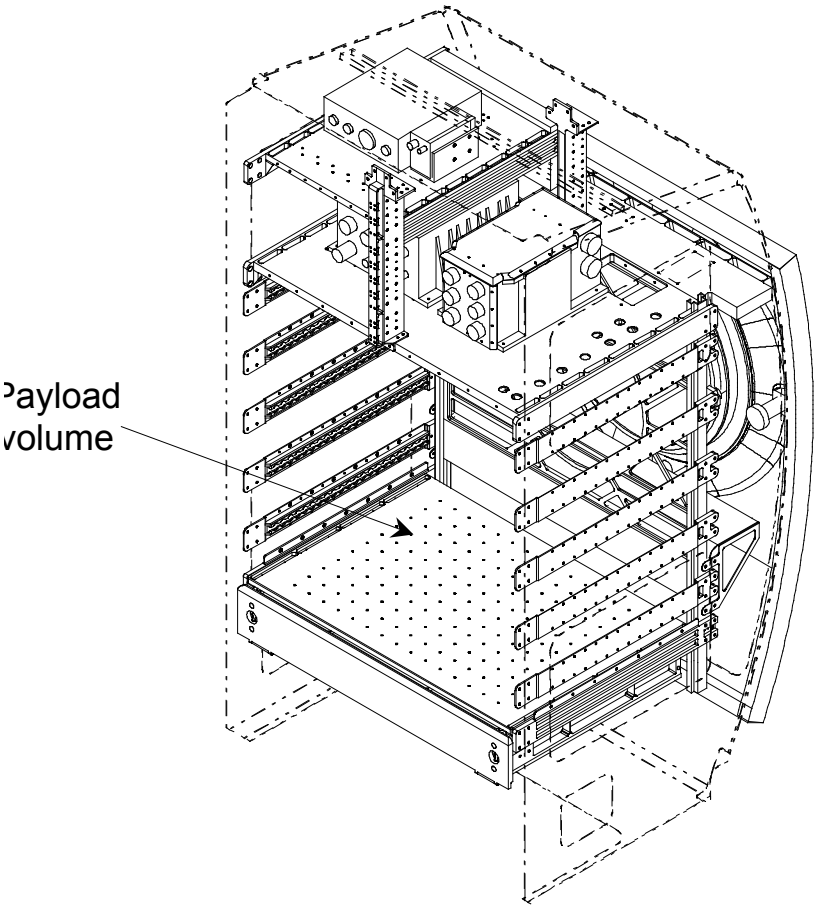
The WORF will be a single-rack facility based on a modified EXPRESS rack. This rack is designed to give payloads access to power, data, moderate temperature cooling, video downlink and a stable mounting area with standardized interfaces for payload deployment. The WORF is designed to handle a payload up to the size of a Leica-Heerburg RC-30 aerial photography camera, with maximum dimensions of 53.3 cm (21-

[1] For comparison, the Space Shuttle Orbiter overhead windows have an optical performance of approximately 2 waves peak-to-valley over 4" (reference wavelength of 632.8 nm); the Skylab S-190B window had an optical performance of approximately $1/3^{th}$ wave peak-to-valley over 3" (reference wavelength of 632.8 nm)

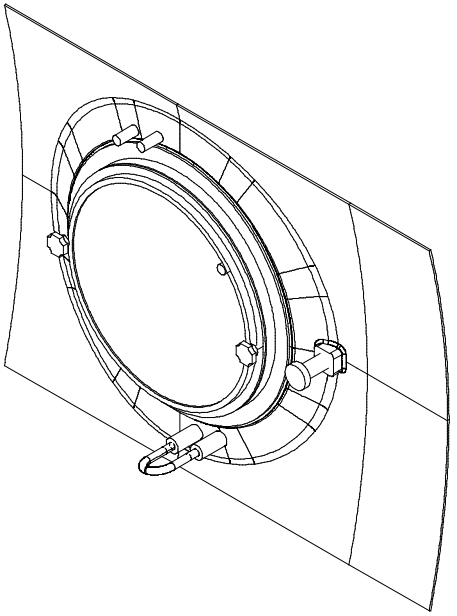
in.) wide by 50.8 cm (20-in.) deep by 76.2 cm (30-in.) long and a maximum mass of 136 kg (299 pounds). Payload area is shown on a set of accompanying figures. It is anticipated that the WORF will supply interfaces for payload mounts on the sidewalls of the payload volume, and will provide a standard bolt interface on the lower surface of the payload volume for payload and avionics mounting. There will be interfaces within the payload volume to provide payloads access to ISS power, data and cooling utilities. The WORF will provide payloads with a maximum power of 3 Kw supplied at 28 Vdc. The maximum data rate will be up to 10 Mbps. The interior of the WORF will be designed to be light-tight and low-reflectance, so payloads will be able to observe low-light-level phenomenon such as aurora, and also be able to support radiometric measurements. At present, design studies are underway to provide the WORF with passive rack-level vibration isolation so as to provide a stable environment for payload operations.

Payloads can be operated in any number of ways, ranging from complete crew interaction with payload operation to completely autonomous, ground-commanded operation with the only crew interaction being initial set-up. For payload set-up, the scratch pane will be removed and bump shield integral to the WORF will be deployed to prevent damage to the aft surface of the primary pressure pane by floating debris. Once payloads are mounted and under control, the bump shield will be retracted and the payload optics will be able to be moved into position directly adjacent to the pressure pane to take advantage of the optical quality of the window. It is anticipated that payload developers will provide all necessary mounting hardware, which will, in turn, mount to the interfaces provided in the payload volume.

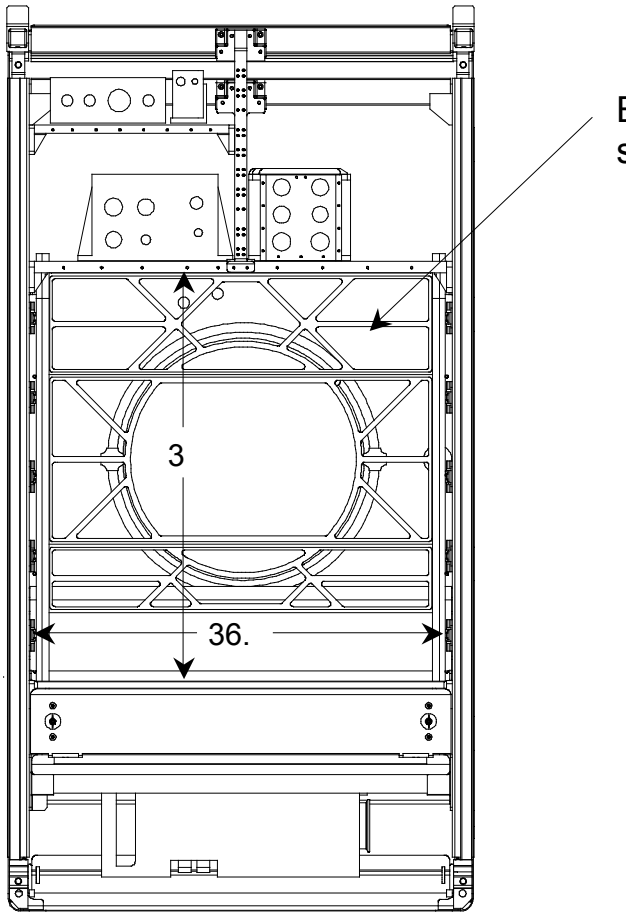
Parties requiring addition information or clarification can contact either Dean Eppler at dean.b.eppler1@jsc.nasa.gov (281-244-8216), Tony Boatright at tony.boatright1@jsc.nasa.gov (281-244-8087), or Betsy Park at 301-286-7062.



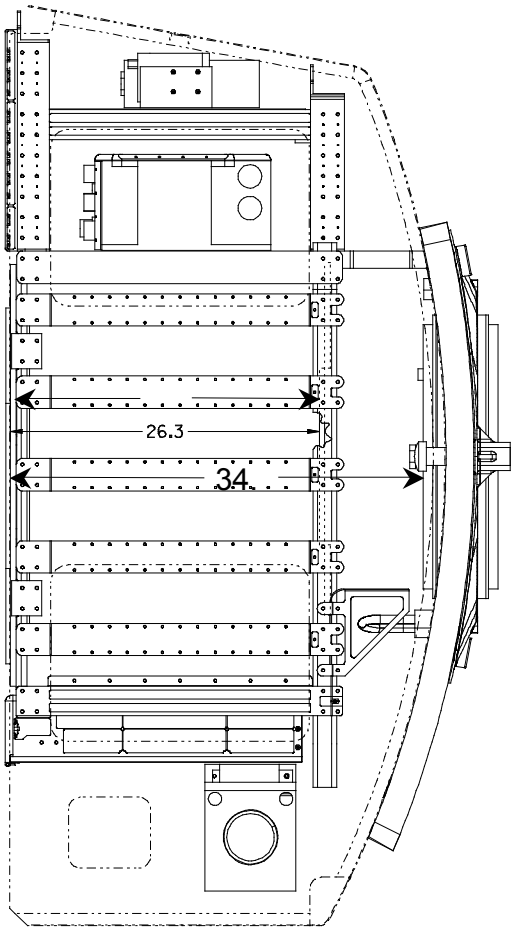
WORF 3/4 schematic view showing
The relationship between payload volume and avionics bays.



US Laboratory nadir window; the pane has a 20” clear viewing area. To the right of the window is the handwheel for opening the window shutter. The “U”-shaped structure
below the window is a quick disconnect (QD) that controls the pressure between the two pressure panes.



WORF Rack face on, showing the dimensions of the payload area; dimensions in inches. The lattice work in front of the window is the deployed bump shield.



WORF Rack side view, showing depth of payload area. The total depth is 34.4". The 6.4" area to the right of the bump shield will be available once the bump shield is retracted, allowing payload use of the whole 34.4".